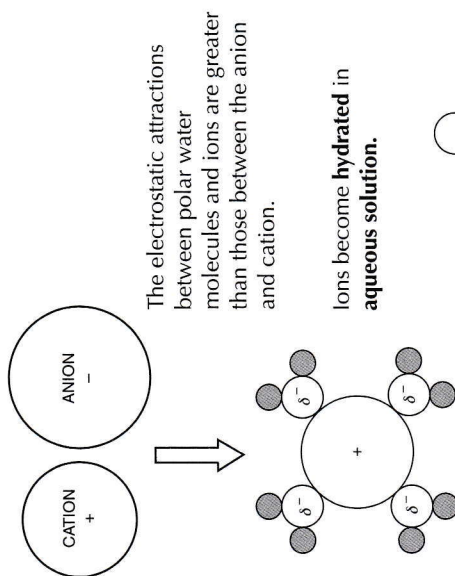


# Physical properties of water

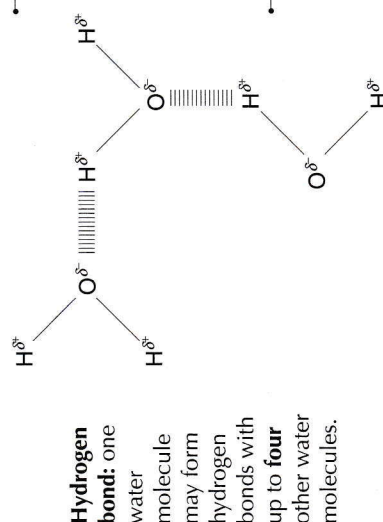
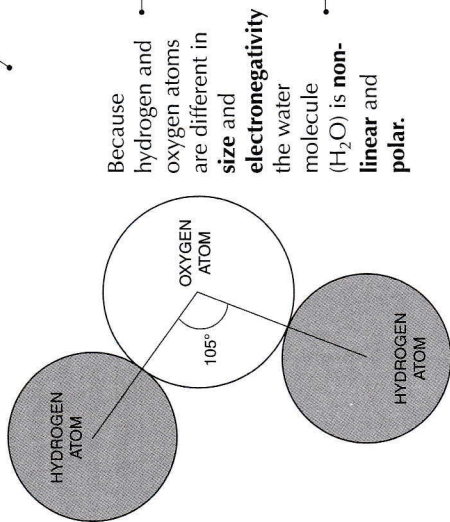
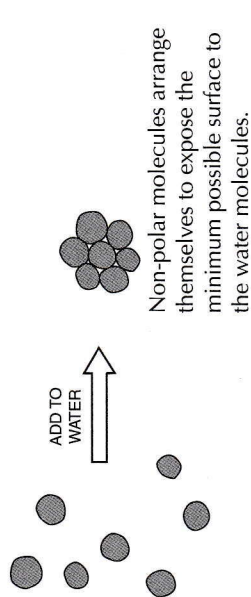
are explained by hydrogen bonding between the individual molecules.

**Solvent properties:** the polarity of water makes it an excellent solvent for other polar molecules ...



Such polar substances, which dissolve in water, are said to be **hydrophilic** ('water-loving').

... but means that non-polar (**hydrophobic** or 'water-hating') substances do not readily dissolve in water.



This polarity means that individual water molecules can form **hydrogen bonds** with other water molecules. Although these individual hydrogen bonds are weak, collectively **they make water a much more stable substance than would otherwise be the case.**

**High specific heat capacity:** the specific heat capacity of water (the amount of heat, measured in joules, required to raise 1 kg of water through  $1^\circ C$ ) is very high: much of the heat absorbed is used to break the hydrogen bonds which hold the water molecules together.

**High latent heat of vaporisation:** hydrogen bonds attract molecules of liquid water to one another and make it difficult for the molecules to escape as vapour: thus a relatively high energy input is necessary to vaporise water and water has a much higher boiling point than other molecules of the same size.

**Molecular mobility:** the weakness of individual hydrogen bonds means that individual water molecules continually jostle one another when in the liquid phase.

**Cohesion and surface tension:** hydrogen bonding causes water molecules to 'stick together', and also to stick to other molecules - the phenomenon of **cohesion**. At the surface of a liquid the inward-acting cohesive forces produce a 'surface tension' as the molecules are particularly attracted to one another.

**Density and freezing properties:** as water cools towards its freezing point the individual molecules slow down sufficiently for each one to form its maximum number of hydrogen bonds. To do this the water molecules in liquid water must move further apart to give enough space for all four hydrogen bonds to fit into. As a result water expands as it freezes, so that ice is less dense than liquid water and therefore floats upon its surface.

**Colloid formation:** some molecules have strong intramolecular forces which prevent their solution in water, but have charged surfaces which attract a covering of water molecules. This covering ensures that the molecules remain dispersed throughout the water, rather than forming large aggregates which could settle out. The dispersed particles and the liquid around them collectively form a **colloid**.